Size and Duration of Empires:

Growth-Decline Curves, 600 B.C. to 600 A.D.

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The first known attempt to explain the duration and supersession of dynasties through calculations was made in the first century B.C. by Tsou Yen or his disciples in China (Eberhard, 1950: 60). The calculations were astrological. The rulers' response was inimical. Maybe this is why no further attempts were made during the next two thousand years, in spite of astrology continuing to flourish. The objectives of the present study are somewhat related to those of Tsou Yen although the calculations avoid astrology; whether that helps to avoid the opprobrium heaped on Tsou Yen's school remains to be seen. As we tackle the period during which this school of thought was born and subsequently crushed, it is only proper to recall the memory of these spiritual ancestors.

This essay is part of a longer study of patterns in size and duration of empire areas. Its specific objective is to report and analyze in detail the growth and decline data for the period ranging from the rise of the unprecedentedly large Median-Persian empire up to the rise of the Muslim empire which was the next step increase in record geographical size. Han Chinese, Roman, Parthian-Sassanid, and Median-Persian empires were the major empires of the period.

The first article in this series (Taagepera, 1978a) presented the motives for detailed empirical study of area changes of empires. It also reviewed previous work, defined terms, and documented an ever-continuing trend toward larger empires. Within this trend, three distinct phases could be distinguished on the basis of sudden size increases.

A second essay (Taagepera, 1978b) dealt with the first of these phases. It started around 3000 B.C. when city building and occupational differentiation led to the first recorded states or empires of more than 0.3 million square kilometers. This phase ended when a

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breakthrough in power delegation ability rapidly raised the maximum empire size from 1.3 million square kilometers in 700 B.C. to 5 million by 500 B.C. Area changes of about thirty best-known empires and states during these 2400 years were established and tabulated. Superimposed and juxtaposed graphs (area versus time) helped to visualize the relative size and time location of these empires. Characteristics for size and duration of individual empires were defined operationally, and a list of actual values was given. (The definitions will be given again briefly in this article). A world-wide territorial concentration index was also tabulated.

This third essay essentially repeats the procedure for the early part of the second major phase, the one ranging from the power delegation revolution around 600 B.C. to a communication technology revolution around 1600 A.D. Like the previous paper, it will deal with about thirty entities. But due to the increasing number of simultaneous empires and of detailed historical information about them, the period covered here is only 1200 years, compared to the previous paper's 2400 years. Even so, the endeavor to record the area patterns of all known empires must be relaxed in favor of two more limited goals.

On the one hand we want to include all truly large empires at a given time, so that the world-wide territorial concentration index (the definition of which will be given later) can be calculated without being affected by omissions. On the other hand, we are also interested even in small entities, if the information on their growth phase is particularly detailed and thus casts light on the general pattern of rise of new empires. Empires of times long past often emerge into history's limelight only when they have reached appreciable size so that the source of their later greatness (or at least bigness) remains problematic. Finally, I have also included some rather small entities (such as Carthage) because they are relatively prominent in the history of the West.

It should be kept in mind that we are dealing here with area rather than power of states, because areas can be relatively unequivocally measured. Areas reflect political power only indirectly. The power of commercial empires, such as the Phoenician city system during the period considered, or multinational corporations today, may be quite independent of the size of area they control in a political-military sense. The same could be said of the realms of

spiritual leaders. Yet graphs showing the area of empires are of interest in their own right, be it that they confirm or disconfirm our previous expectations.

The cutoff around 600 A.D. is a matter of convenience: The Muslim conquest terminated the life course of many an empire West of Indus; at the same time, India underwent marked fragmentation; and East Asia underwent a transition from dominance of the steppe empires to that of the Chinese T'ang Dynasty. Thus the period around 600 A.D. was one of small and vanishing empires.

Geographically, it is convenient to divide the world of empires during the period considered into four regions: Eastern Asia (approximately present-day China and Siberia); Southern Asia (India and the Central Asian highlands); Western Asia (Iran, Mesopotamia); and Afro-Europe. Interactions among empires within those regions were intense, and interactions between regions were limited, except for Western Asia with its pivotal location.

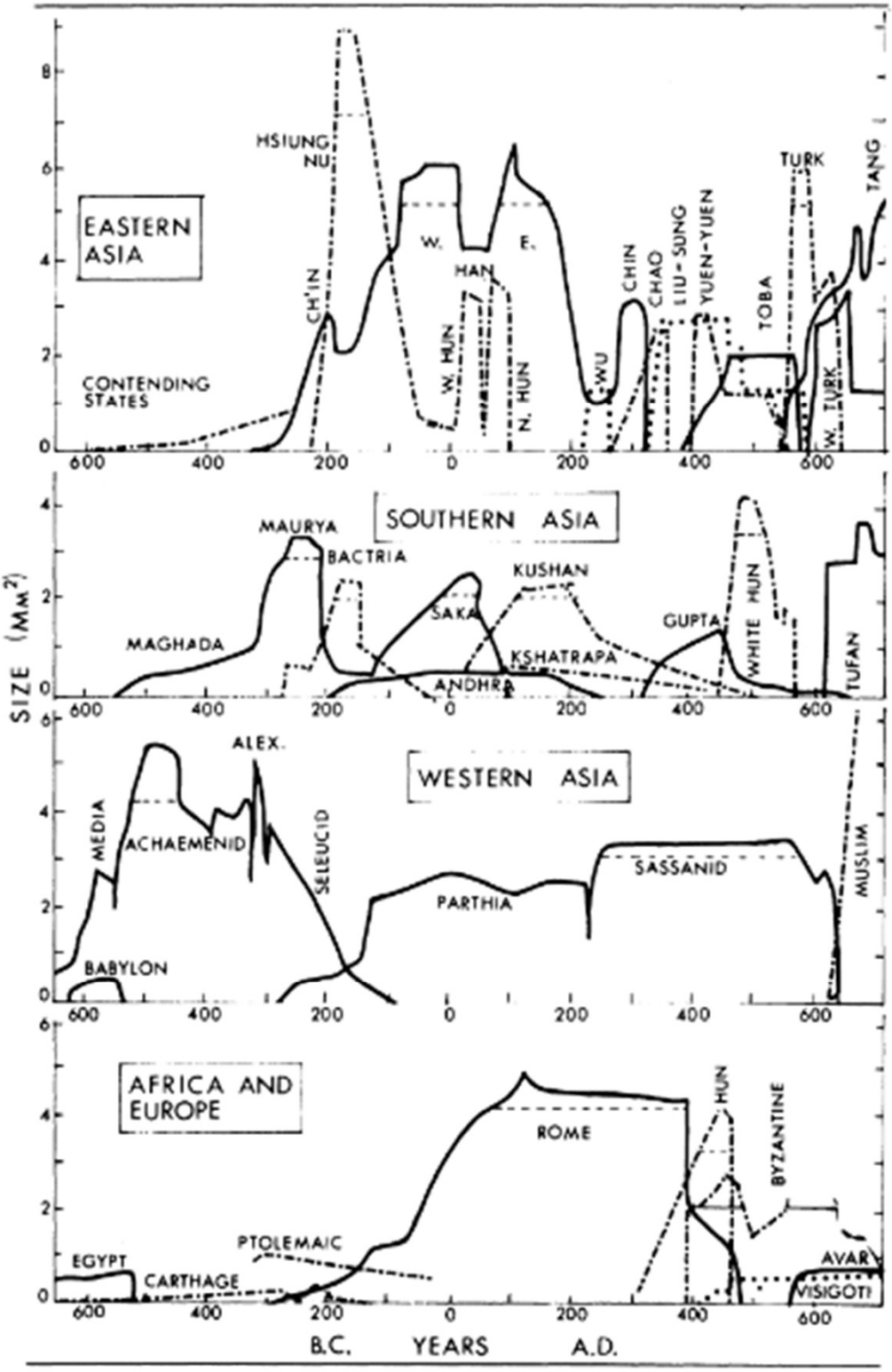
After briefly defining the terms used, empires in these four regions of convenience will be discussed. Then the world-wide trend will be evaluated. Results are shown in a concentrated form in Figure 1 where the areas of major empires are plotted versus time. Each of the four regions is plotted separately in order to avoid excessive cluttering. However, the time scales of these sub-graphs are juxtaposed and areas are plotted to the same scale so that direct visual comparison of patterns and sizes is possible.

DEFINITION OF TERMS

Most of these definitions have been discussed and justified in previous articles (Taagepera, 1978a and 1978b) to which the reader should refer for further clarifications.

"Empire" designates any relatively large sovereign political entity whose components are not sovereign. In the case of feudal structures where sovereignty is not located clearly at any one level, the more durable level is given preference. Empire size (S) at any given time (t) is defined as the dry land area it controls, at least in the sense of having some undisputed military and taxation prerogatives. This area is determined on the basis of the consensus of historians as expressed through maps in historical atlases and other texts. The area

Figure 1. Growth-Decline curves of Empires 650 B.C. to 700 A.D.*



*Data from Tables 1-4. Horizontal dashed lines across peaks indicate stable maximum size as defined in text.

unit used is megameter square, abbreviated as "Mm^2". Since 1 Mm = 1000 km, we have 1 $Mm^2 = 10^6$ $km^2 = 0.39$ million square miles. The geographical size is often but not always correlated with the extent of political or military power. It may have no relation at all with cultural, spiritual, or even commercial power. It is not implied that larger size is inherently better from any practical or moral viewpoint.

The *size-time integral* (I) of an empire is the area under its size-versus-time curve. Measured in square megameter-centuries (abbreviated as "Mm^2c"), I is a direct measure of an empire's impact on history, as far as the impact depends on sheer combination of size and duration.

An empire's *stable maximum size* (M) is the size level such that I would be reduced by 5% if parts of the S(t) curve above the M level were lowered to that level.

The *emergence date* (E) is the date at which an empire first reaches 20% of its eventual stable maximum size. *Adulthood date* (A) comes when the empire first reaches 80% of M. *Failure date* (F) is the date at which an empire, after having reached its maximum stable size, first falls below 50% of it.

Rise time (R) is the period (in centuries) from emergence to adulthood: R = A − E. Similarly, *duration time* (D) is the period (in centuries) from adulthood to failure: D = F − A. These operational definitions have been justified earlier in Taagepera (1978b), except for E and R for which there was no need because sufficiently precise data for the growth periods of pre-600 B.C. empires are practically nonexistent. In engineering practices, 10% and 90% levels would often be used to define the rise period of a curve. Due to uncertainties of empire growth curves at very small and nearly maximum sizes, the 20% and 80% levels seem to carry more noise-free information in the present case.

Nothing of a biological or anthropomorphic nature should be read into the terms used here. "Growth" is here just a short term standing for "increase in system size as time increases," just as physicists talk of crystal growth without harboring any delusions regarding the inanimate nature of those crystals. "Adulthood" stands for the "end of the growth period." Instead of inventing new terms, the short terms which first evolved for the description of biological systems can often be extended or modified for use with

other systems, without implying that all systems with fairly regular growth patterns be quasi-biological.

In order to define empire duration adequately, brief periods of temporary disorder should not be construed as failure dates. Operationally, two successive empires with the same geographical core location are considered here as distinct only when the gap between them (measured at the 0.5M level of the first empire) lasts longer than 30% of the first empire's duration. Two empires are considered successive if they do not coexist for more than 10% of the earlier empire's duration time.

All of the preceding definitions refer to characterization of individual empires. The world-wide concentration into smaller or larger political entities can be expressed by the following index (Michaely, 1962):

$$C = 100\% \sqrt{\Sigma (S_i/S)^2} \qquad [1]$$

where S_i is the area of the i-th country, and S is the world total dry land area (133 Mm^2, without Antarctica). Concentration index C expresses the percentage of the world which is enclosed by the largest empire, if only one predominates, or by a weighted combination of the largest empires, if many of them are of comparable size. The increments due to smaller countries rapidly become negligible when S_i falls below the top empire's size, as illustrated by sample calculations in Taagepera (1978b).

In this essay, an attempt is made to tabulate data for all empires with maximum stable size of more than 0.5 Mm^2 and with size-time integral of more than 1.5Mm^2c. Possible error range in areas is 10% unless a wider range is indicated in Tables 1 to 4.

WESTERN ASIA

Apart from the New Babylonian Empire which lasted until 539 B.C. and for which data are tabulated in Taagepera (1978b), all Western Asian empires of this period had a core location in the present-day Iran. Two composite empires can be distinguished: the Median-Persian-Alexandrian-Seleucid, and the Parthian-Sassanid. Data are shown in Table 1 and plotted in Figure 1.

Table 1 Western Asia

Date	Entity	Area (Mn^2)	Source	Notes
835 B.C.	Media	----	a	First mention by Assyrians
700		.5	b,a	Unified state
625		.8±.3	a	Expansion starts
585		2.8	b,c	Peak size
550		.00	a	Takeover by Persians
580 B.C.	Achaemenid Persia	.5	a	Self-assertion within Media
550		2.5	b,a	Media taken over
539		3.6	b	Lydia, Babylon taken
525		4.1	b	Conquest of Egypt
500		5.5	b	Peak size
480		5.4	b,a	Decline starts
390		3.6	a,b,o	Egypt lost in 448
387		4.1	a	Asia Minor retaken
335		4.4	b,o	Egypt retaken
330		0.0	a	Conquest by Alexander
335 B.C.	Alexander	.1	d	Conquest of Persia starts
330		2.5	d	Alexander's Iranization starts
323		5.2	b,d	Peak size. Alexander's death
311		4.4	e,o	Seleucus becomes vice-roy
303	Seleucid	3.0	e,a	Largest splinter.
301		3.9	f,a	Peak size
270		3.2	g	
240		2.6	g,a	Parthia, Bactria lost
185		1.3±.2	e,f,a	Gradual loss of Iran, Anatolia
175		.8	h	
133		.25	e	
100		.10	h	Residue in Syria
64		.00	e,a	Roman conquest
270 B.C.	Parthia	.1	g,i,a	Parnian invasion
240		.5	e,a	State formation
200		.5	a	f: 1.1 Mn^2
175		.7±.2	a,h	
145		.8	a	
135		2.1	a	h: 1.5 Mn^2 around 100 B.C.
50		2.6	a,e	
0		2.8	g	
50 A.D.		2.6	c	h: 1.5 Mn^2 around 50 A.D.
200		2.6±.3	j,k	
227		.00	a	Sassanid takeover

Table 1 (Continued)

Date	Entity	Area (Mm^2)	Source	Notes
227 A.D.	Sassanid Persia	2.3	a,g	Takeover from Parthians
450		3.4	e,g	e: 5.4 Mm^2 from 250 to 420 A.D.
550		3.5	c	Indus and Mediterranean reached
600		2.6	e,g	
615		2.8	g,h,a	Egypt taken
630		2.6	g,o	Severe defeats by Byzantines
642		.0	a,o	Destruction by Muslims

a: Kinder and Hilgemann (1964)
b: Hammond (1968)
c: Roolvink (1957)
d: Encyclopedia Britannica (1968)
e: Engel (1953)
f: Putzger (1961)
g: Stier (1956 & 1963)
h: Herrmann (1966)
i: Palmer (1957)
j: Sellman (1954)
k: Muir (1961)
l: Davies (1949)
m: Shepherd (1956)
n: Hazard (1954)
o: Otava (1970)
p: Eberhard (1950)
q: Dunbar (1937)
r: Holsti (1967)
s: Haack (1973)

Areas are in square megameters (Mm^2)

There seems to be little information on the growth phase of the Median empire before it rapidly became larger than any previous empire in human history. Achaemenid Persia first developed as a province within the declining Median empire which it then seized, reunified, and expanded. Although the ethnic identity of the dominant Iranian tribe thus changed, there was no long period of disorganization between the Median and the Achaemenid rules. Therefore, they are counted as phases of the same empire, according to the discontinuity criteria formulated earlier. Successful delegation of nonsovereign power to satrapies may have been the major factor in extending the empire to super-record size.

Although Alexander's initial core area was on the outskirts of the Persian empire, his conquests represent a takeover of an existing framework rather than the building of a new empire. After Darius III was defeated, Alexander's march through his realm had in many ways the elements of an assertion of power by a new king on an old throne. In order to reinforce his claim to legitimacy, he married into the dynasty he had defeated, and rapidly started to adopt the Iranian customs. When he attempted further conquests in the Indus valley

beyond the traditional Achaemenid realm, his success was limited and he soon gave up, although Western history schoolbooks often talk of his "conquest of India," blithely oblivious of the marginal location of the Indus River within the Indian subcontinent. Alexander barely reached the border of the country presently called India. A superimposition of the maps of Achaemenid and Alexander's empires shows a 90% match, except that Alexander's realm never reached the peak size of the Achaemenid realm. Alexander was not an empire-founder but an empire-seizer who arrested the decline of the Iranian empire for a few years.

Among the successor states only two were eventually consolidated into empires of appreciable size and duration: the Ptolemaic empire to be discussed within the Afro-European context, and the Seleucid empire which initially occupied the core region of previous Iranian empires and, therefore, is considered here to be a continuation of them. Later on, the Seleucids were gradually pushed out of Iran while at the same time gaining new ground in Syria where the shrinking rump state was eventually annexed by Rome.

The Parthian empire represents a gradual construction of a new entity. Starting from a marginal position relative to the Seleucid empire, the Parthian state co-existed with the latter for more than a century. In contrast, the speed of the later Sassanid takeover of the whole Parthian empire suggests continuity. In view of the Sassanid empire's size, duration, cultural level, and proximity to Europe, it is surprising to see how little attention Western-style world history texts tend to give it. It remains totally in the shadow of its Roman contemporary, and of its successor, the Muslim empire which grew out of a different corner of Western Asia.

AFRO-EUROPE

Except toward the end of the period considered, known empires of any appreciable size rose in Africa and Europe only near the Mediterranean. Data for the Later Period of Ancient Egypt have been tabulated in Taagepera (1978b). The Ptolemaic splinter of the Iranian empire occupied the same area, and was the last major empire formation with an Egyptian core before the rise of Fatimids a thousand years later. In view of the previous predomination of

Egypt among the early large empires, the shift away from this area seems rather abrupt and noteworthy. The data for the Ptolemaic and for all other Afro-European empires are tabulated in Table 2, and shown in Figure 1.

Carthage is shown, despite its small size, to put into perspective its long existence at a modest size before Rome caught up with it. At the time of the Punic Wars the territory held by each of the two rivals was about equal, was expanding at a comparable rate, and remained small compared to the contemporary Seleucid, Parthian, and even Ptolemaic realms. Little growth data were found for Greek city states although the relatively steady growth of Sparta might yet yield meaningful growth indicator values.

Rome is the first empire in history for which detailed early growth data are available. The growth pattern agrees quite well with the simple logistic equation (Taagepera, 1968). The partition of the Roman empire, in 395 A.D., into two fairly equal parts presents another problem of continuity. I have preferred to consider the Western part as the continuation of the original empire, in view of the identical ethnic and geographical core. The Greek-language Byzantine empire is considered to be a new splinter empire. Its area data are tabulated here up to its end around 1456, since its largest extension occurs during the period considered here.

With the Huns we have the first geographically European empire not on the Mediterranean coast. Little is known about the extent of its control in the Volga and the Baltic Sea. Therefore, the error margin is very wide. Visigoths seem to have founded the only Germanic state which achieved not only a fair size but also duration during the period considered. Many other Germanic tribes (Langobards, Vandals, Ostrogoths, and others) occasionally formed states of comparable or even larger area, but their duration was limited to a few decades. The rather durable Frankish kingdom remained small until 700 A.D.; its area data will be tabulated in a subsequent paper dealing with the period after 600 A.D. A second steppes empire centered in the Danube bend was formed by the Avars. Smaller than the Hun empire, it was to last appreciably longer.

Table 2 Africa and Europe

Date	Entity	Area (Mn^2)	Source	Notes
814 B.C.	Carthage	.00	a	Foundation
650		.1±.03	a	Indepencent; protector of Western
400		.1	a	Phonecian colonies
270		.20	a	
238		.18	a	Sardinia, Corsica lost
220		.30	a	Conquests in Spain
202		.05	a	Loss of Spain, Numidia
146		.00	a	Roman conquest
323 B.C.	Ptolemaic Egypt	(.8)	a	Ptolemaios becomes Diadoch in Egypt
301		1.0	a	Formal dissolution of Alexander's empire
180		.8	a	
30		.0	a	Roman conquest
500 B.C.	Rome	.001	m	Foundation in 750 B.C.
326		.01	m	Latium held
264		.13	m	Central and lower Italy held
200		.36	m	Sicily, Illyria, Southern Spain
150		.65	m	Greece, Carthage
146		.80	m	
133		1.05	m	W. Anatolia, Spain
100		1.20	m	
75		1.30	m	Syria, Egypt, Anatolia, Gallia
50		1.95	m	
25		2.75	m	Mauretania, Germania
0		3.4	m	
50 A.D.		4.2	m	Pannonia, Thrace
83		4.3	m	Armenia, Brittany
117		5.0	m	Dacia, Mesopotamia. Peak size
138		4.6	m	Loss of Mesopotamia
275		4.5	m	Dacia, Limes lost
390		4.4	m	
395	Western Rome	2.0	m	Partition
476		.00	m	Collapse
395 A.D.	Byzantine Empire	2.1±.3	m,a	Partition of Roman empire
450		2.8	m	
486		1.6	m	
527		1.9±.3	a,m	Justian's rule starts
555		2.7	a,m	Italy, N. Africa, Spain taken. Peak size
570		2.3±.3	a,m	Italy lost to Langobards
591		2.5	a	Armenia taken
600		2.3	m,a	Arabs take N. Africa around 642
700		1.0	e,o	Bulgarians in Balkans since 679
750		1.0	m	

Table 2 (Continued)

Date	Entity	Area (Mn^2)	Source	Notes
800		.8	m,n	
900		.75	n	
1000		1.0	n,o,e	
1025		1.35	e	Peak size: Bulgaria taken
1095		.5±.15	n,o,e	Seljuks in Anatolia, around 1076
1150		.6	e	Anatolia retaken 1130-1176
1200		.5	n,o,e	
1204		.35	e	Latin empire 1205-1261
1300		.3±.1	n,o,e	
1350		.05	e	
1400		.03±.01	n,o,e	Ottoman Turks in Europe by 1361
1453		.0006	e	Constantinople falls
1479		.0000	e	Last outposts surrender
375	A.D. Huns	2.5±1.0	a	Submission of Ostrogoths in Ukraine
441		4±1	a	Center in Danube Valley. Attila
460		.0	a	Destruction by Gepids
419	A.D. Visigoths	.1 ?	a	State creation around Toulouse
484		.5	a	Peak power
507		.4	a	Loss of Aquitania to Franks
526		.5	a	Expansion to S. Spain
551		.4	a	S. Spain lost to Byzantines
580		.6	a	All of Iberia held
711		.0	a	Destruction by Arabs
558	A.D. Avars	.5 ?	a	Arrival from Mongolia to Danube
600		.8 ?	a	Peak size
796		.0	a	Destruction by Charlemagne

Source code: See Table 1.

EASTERN ASIA

Eastern Asia is the most baffling of the four regions. Variations in Western spellings of names of peoples, states, and dynasties do not help. The same entity may be called Juan-juan or Yuen Yuen or Jou-Jan or Shou Shan. Ch'in may be spelled Ts'in but is different from Chin or Tsin. The scene itself is inherently complex and unstable. Tribes fuse, split, form alliances, fight, conquer, and vanish regardless of ethnic-linguistic affinities or differences. Nomadic empires and sedentary dynasties appear and vanish in a matter of years, sometimes to reappear decades or even centuries later.

Dynastic changes may mean gradual state building or takeover of existing structures (or parts of them) from within or from without. Nomadic conquerors end up as champions of sedentary culture against new waves of nomads. Sedentary peasants and scholars emigrate and reinforce the nomadic empires. Thai, Tibetan, Han Chinese, Turkish and Mongol interpenetration, conflict, and symbiosis is ever-present and diffuse in a region which is now so preponderantly Han Chinese that one finds it difficult to visualize how different the picture was even ten centuries ago when ethnic borders in Europe were already quite similar to the present ones.

There is little information on the identity and area change of the Chinese feudal states from 600 to 300 B.C. On the basis of the known total number of states, estimates of the largest component's size have been made. Such an estimate is needed because we are trying to establish the size of the largest three states at any time and some of the Chinese "Contending States" were fairly large. The area data for Eastern Asia are shown in Table 3.

The Ch'in-Han-Chin unified China offers the sole fairly clear-cut period. The Ch'in unification is directly connected to the Ch'in core state's ability to dismantle feudalism and replace it by a centralized bureaucracy—the characteristic feature that enabled the empires of 600 B.C. and later to become much larger than the prebureaucratic ones. The specific Ch'in device for preventing secession by province governors was to have each province ruled by three equally powerful functionaries: the civil and military governors, plus a controller (Eberhard, 1950: 64). The extent of Hsuing-Nu (Hun) penetration of China around 175 B.C. is unclear but it does not seem to interrupt the continuity of the Han rule. Estimates of the peak area controlled by Western Han range from 4.4 Mm^2 (Stier, 1956: 46) to 6.2 Mm^2 (Herrmann, 1966: 16) mainly due to questionable control of Mongolia. Agreement on the peak size of Eastern (or Later) Han empire is quite good.

Estimates of the Hsiung-Nu peak size also vary, from 6.5 Mm^2 (Stier, 1956: 46) to a high of 9.6 Mm^2 (Herrmann, 1966: 8, 11) which would make it by far the largest world empire before the rise of the Muslim empire 800 years later. The Hun empire cannot be discounted as merely an empty desert with a few wild nomads. There may have been 3 million people (Eberhard, 1950: 111) at a time when China may have had 20 million at most, and many of the Hun

Table 3 Eastern Asia

Date	Entity	Area (Mm^2)	Source	Notes
600 B.C.	Feucal China	.05±.03	r,p	Estimate for the largest of 100 states
500		.15±.08	r,p	Estimate for the largest of 15 states
350		.5±.3	r,p	Estimate for the largest of 10 states
300	Ch'u	.8	h,a	Largest of the contending states
300 B.C.	Ch'in (Ts'in)	.1	a	Feudalism yields to centralized bureaucracy
250		1.3	p,r	Most of China conquered. Imperial title
220		2.3	h,p,r	Last Chinese states conquered
206	Western Han	2.8	h	Expansion to Canton
176		2.1	g	Peak of Hun invasion
110		4.0	g,p	Kansu, Ordos, Yunnan, Tongking
80		5.7	g,h	North Korea, Turkestan
50		6.0	g,h,p	Southern Huns submit
10 A.D.		4.7	g,h	Turkestan lost. End of W. Han
73	Eastern Han	5.0	g,p	Turkestan reconquered
100	(Later Han)	6.5	j,g,h	Mongolia, Annam
105		5.7	p	Tangut advance into Turkestan
200		2.5±1.2	p	Gradual fragmentation since 150 A.D.
220	Wei	1	p	"Three Kingdoms". Wei gets imperial title
263		2	p	Conquest of Shu Han
280	Chin (Ts'in)	3.1	h,p	Conquest of Wu: unification of China
316		.0	p	Gradual loss of control to nomads
230 B.C.	Hsuing-Nu	.5	h	Turkish state formation starts in Mongolia
210	(Huns)	2.5±1.0	h,p	Unification of Huns around 220 B.C.
176		9±1	h,g	N. China, S. Siberia, Turkestan. Peak size
110		5±1	p	Chinese attacks since 133 B.C.
80		2.5	h	Tin-ling revolt in Siberia
50 B.C.		.8±.5	h	Fragmentation. Parts submit to China
20 A.D.	Western Huns	3.5	p,q	Turkestan-Balkash-Baikal, 10 to 40 A.D.
50		.5±.3	p	Famine revolts, splits, Chinese conquest
60	Northern Huns	1.51	p	Last attempts to control Turkestan. Defeat by 90 A.D.
221 A.D.	Wu	1.5	h	Formation after Han collapse
280		.0		Absorption by Wei
221 A.D.	Shu Han	1	h	Formation after Han collapse
263		.0		Absorption by Wei
287 A.D.	Huns	.8±.5	p	Unification of Hun 19 tribes in Shansi
316	Earlier Chao	2±1	p	Northwest China conquered
329	Later Chao	2.5±1.0	p	North China held
352		.0	p	Destruction by Hsien Pi Mongols
317 A.D.	Eastern Chin	2.0	p	Formation near Nanking, after Chin collapse
347		2.8	h,p	Szechuan held. Sung dynasty in 420
450	Liu-Sung	2.0	p	Areas north of Yangtze lost to Toba

Table 3 (Continued)

Date	Entity	Area (Mm^2)	Source	Notes
502	Liang	1.3	h,p	Internal takeover
549	Later Liang	1.3	p	External takeover. N. Chou control
585		.0	p	Absorption by Sui
351 A.D.	Earlier Ch'in	.0	p	Tibetan state formation in Shensi
376		2±1	p	Northern China held
394		.0	p	Fragmentation
390 A.D.	Yuen Yuen	.0		Mongol state formation in Mongolia
405	[Jou-jan, Shou Shan]	2.8±.5	g,h	From Manchuria to Balkash
429		1?	p	Blocked by Toba in N. China
552		.0	p	Defeat by T'u Chueh. Vanish from history
385 A.D.	Toba	.0	p	Turkish state formation in Shanshi
409		1.0	g,p	Northeast China held
440		1.5±.5	g,p	Northwest China conquered
450		2.0±.5	g,p	Yangtze reached
557	N. Ch'i	1.5	p	Internal takeover. NW lost to N. Chou
577		.0	p	Divided between Turks and Chou
540 A.D.	T'u Chueh	.0	p	Turkish independence from Yuen Yuen
552	(Gok) Turks	5	p	Yuen Yuen defeated. Dominance of C. Asia
557		6	h,p	Expansion to East Mongolia
582	E. Turks	3	h,p	Split
624		4 ?	p	Maximum power of E. Turks
640		.0	p	Destruction by Uighur revolt
582 A.D.	W. Turks	2.8	p	Split
630		3.5 ?	p	Expansion to Turkestan
650		1 ?	p	Defeat by Uighurs, Chinese
698	N. Turks	?	P	Empire reformed
745		.0	g	
550 A.D.	N. Chou	1.0	p	Break away from N. Ch'i; Turkish
577		1.5	p	N. Ch'i divided with Turks
581	Sui	1.5	p	Internal takeover
589		3.0	h,p	Later Liang, Ch'en taken: unification
618	T'ang	3.0	h	Restoration after brief collapse

Source code: See Table 1.

subjects were settled artisans, peasants, and even scholars in charge of the record-keeping. There is little information on the brief Western and Northern Hun empires in Turkestan around 10 to 90 A.D. Each of them must be considered a distinct empire according to our distinctions rule.

During the troubled period of 200 to 600 A.D., continuities in state identity should be established regardless of dynastic shifts. Thus the Wei state during the "Three Kingdoms" period seems to be the core for Chin reunification of China. Moreover, according to the operational continuity criterion defined earlier, the interlude between the Han and Chin peaks is so short that the whole Ch'in-Han-Chin period is to be considered as a single empire that disappears in 316 A.D. with gradual loss of control to the Huns. The other two of the Three Kingdoms (Wu and Shu Han) are tabulated as separate entities. The subsequent Southern Chinese state of Eastern Chin is considered to be a new state because of the shift both in leadership and geographical locus. It is considered to continue through numerous dynasty changes (Liu-Sung, Southern Ch'i, Liang, Later Liang) in spite of indirect Northern Chou control of Later Liang, until Southern China was absorbed by the unified Sui empire in 585.

A new Hunnish state in China continues as the "Hun Han" or Chao dynasty. The Tibetan-origin Earlier Ch'in is also shown in Table 3 but not in Figure 1 because of its short duration. In general, entities lasting for less than 50 years are neglected unless their peak size amounts to more than 2.5 Mm^2. The Turko-Mongol steppe empire of the Yuen-Yuen (Jou-jan or Juan-juan in Herrmann, 1966: Shou-Shan in Stier, 1956) seems to continue for a century at moderate size.

The originally Turkish Toba (To-pa) empire is considered to continue under the Chinese Northern Ch'i dynasty. On the other hand, Northern Chou is territorially a new state although ethnically it restores the Toba leadership; after internal takeover by Sui it becomes the core of a new unified Chinese empire under the T'ang dynasty.

The T'u Chueh (Gok Turk) empire reached considerable size for a few decades before splitting into West and East Turks, both still controlling large areas. The East Turks are here considered to continue the original empire, since the West Turks moved to a new location further west. Their pattern of conflict with, and submission to, China, defeats and conquests in Turkestan and Mongolia, and tribal relations defy any description in terms of square kilometers.

SOUTHERN ASIA

This region includes the present India, Pakistan, Tibet, and Afghanistan. Data are shown in Table 4. Three centers of empires emerge around 300 B.C.: Maghada in the Ganges valley (on an Aryan basis), the Indus Valley (under the impact of various invaders from the Northwest), and the Dravida Dekkan. In all these areas, tribal dynasties had been formed at least by 600 B.C. The largest among them may have been the Kosala League (Dunbar 1937: 26) on the upper Ganges. Maghada first expanded around 520 B.C. and, after a long apparently stable period, developed into a major world empire under the Maurya dynasty. After Asoka's death, Maghada shrinks back to a core area which apparently remains unconquered from the outside and expands anew much later, in the form of the Gupta empire.

A first major empire in the Northwest was that of Bactria, with its core in present Afghanistan from which it expanded into the Indus region, a pattern to be repeated several times by other conquerors. Originally a Seleucid province, Bactria's date of independent statehood is hard to specify. The brief reassertion of Seleucid control in the years after 206 B.C. is neglected here. The Bactrian empire was invaded from the Northwest by the Saka, followed in turn by the Kushans under whose suzerainty the Saka states continued to exist and occasionally reassert themselves. A look at the map shows that the borders of the Bactrian, Saka, and Kushan empires at their peak size are very similar. As in Northern China, geography and cultural tradition seem to impose a certain framework on the successive conquerors. After a discontinuity, the White Huns, from 470 to 565 A.D., again tend to fill the same space. The Saka and Kushan empires might almost be considered stages within the same empire, much like the Median, Achaemenid, and Seleucid empires formed a historical geographical continuum.

Apart from Asoka's conquest, the Dravida South remains isolated from the disturbances in the Indus-Ganges region. Durable but small states are the rule. Even the largest ones (like Andhra) remain small on a world scale. The Tibetan Tufan empire that at times expanded into the Ganges Valley will be discussed in a subsequent paper.

Table 4 Southern Asia

Date	Entity	Area (Mn^2)	Source	Notes
543 B.C.	Kosala League	.5	q	From 600 B.C. to 510 B.C.?
600 B.C.	Maghada	.00	q	Approximate formation date
540	(Kshatriya)	.05	q	
530		.1	q	Anga conquered
510		.5	q	Kasi, Kosala, Videka conquered
321	(Maurya)	1±.5	e,q	Chandragupta takeover
297		2.3	j,q	Indus, Hindukush reached
272		2.8±.5	j,q	Asoka's reign starts
261		3.4	j,q,s	Kalinga conquered
230		2.5	q	Kalinga independent
210	(E. Maurya)	1.3	q	Split. Bactria destroys West by 190 B.C.
184		.5	g	Shrinks to Maghada core
270 B.C.	Bactria	.7	g	Autonomy under Seleucids
240		.7	g,i,q	Independence
206		1.0	g,q	Brief spell of Seleucid control
200		1.8	f	Indus area taken from Maurya
184		2.5±.6	e,g,a	Peak size
150	Western Bactria	1.1	q	Split: East and West Dynasties
135		.8	q	Skyths takeover starts
58		.3	q	(Eastern Bactria conquered)
25		.0	q	Western Bactria conquered
135 B.C.	Saka	.8	q	Conquest of Indus area starts
25	(Pahlava)	2.0	g	
20 A.D.		2.6	q	Ganges basin held until 45 A.D.?
50		2.0	q	Kushan attack starts
90				Kushan suzerainity imposed
25 A.D.	Kushan	.8	q	Kushan tribe unites the Yueh-Chi in Bactria
90		2.0±.5	g,h	Conquest of Saka empire completed
200		2.5	j,k,g,q	Expansion into Central Asia
226		1?	q,a	Collapse; Sassanid suzerainity
450		.3±.05	g,h	Rump state around Kabul until 465
200 B.C.	Andhra (Satavahana)	.0	q	Independence
150		.5	a,g	Expansion to West Coast
195 A.D.		.3	a,q	Decline
250		.0	q	Vanishes
100 A.D.	Kshatrapa	.5	a	Formation by Sak refugees from Parthia
405		.0	a	Demise
320 A.D.	Gupta	.1	q,j,a	Maghada expansion starts
344		.6	j	s: .15 Mn^2
395		1.2±.4	j,l	Vague control of North-East
440		1.7±.3	h,g,s	
470		.5	q,a	Losses to White Huns. Rump State in Maghada until 700 A.D.

Table 4 (Continued)

Date	Entity	Area (Mm^2)	Source	Notes
450	White Huns	1	q	State formation in Transoxania
470	(Heptitalites)	4	q	NW India conquered
528		2	q	India lost
565		.0	q	Destruction by Sassanids

Source code: See Table 1.

SIZE AND DURATION CHARACTERISTICS

Table 5 lists the size-time integral, the maximum stable size, the adulthood date, and the rise and duration times for all empires discussed which have an integral value of at least 1.5 Mm^2c. For composite empires, the integral for each component is listed separately at the bottom of the Table; the other characteristics would have little meaning in the case of components. Emergence and failure dates can be easily obtained from data shown by using E = A - R and F = A + D with proper time units.

The Han, Parthian-Sassanid, Roman, and Achaemenid empires have the largest size-time integral; the Byzantine and Hsiung Nu integrals have only one-half of the top value, and all other empires have a quarter or less of the top integral value. Altogether, 22 empires have more than 1.5 Mm^2c; during all previous human history, only 6 empires reached this level (Taagepera, 1978b), with a maximum of 6 Mm^2c (for the Hsia-Shang).

The maximum stable size is largest for the Hsiung Nu Huns, the T'u Chueh Turks, and the Han empire, followed by Rome and the Achaemenid empire. The largest M reached during previous human history (Assyria, 1.0 Mm^2) is surpassed by 18 entities in Table 5.

Duration time at fairly stable size is by far the largest for the Parthian-Sassanid empire (7 centuries) followed by Rome, Andhra, the Byzantine and Ptolemaic empires (around 3 to 4 centuries). The huge Hun and Turk empires lasted for 1 century or less. The combined impact of large size and short duration is well expressed by their moderate size-time integral value. We are likely to have missed some desert empires of very short duration but with a momentary size that might yield an integral value above our 1.5 Mm^2c cutoff point. Among earlier empires, 5 reached a stable duration of at

Table 5 Size and Duration Characteristics of Empires, 600 B.C. to 600 A.D.

Empire	Core Location	Size-Time Integral I (Mm^2c)	Maximum Stable Size M(Mm^2)	Adulthood Date A	Rise Time, R (centuries)	Duration Time, D (centuries)
Ch'in/Han/Chin	China	22	5.2	90 B.C.	1.6	2.9
Parthia/Sassanid	Iran	22	3.1	60±20 B.C.	1.2±.4	7.0
Rome	Europe	21	4.2	0	1.4	4.0
Achaemenid/Seleucid	Iran	17	4.2	540 B.C.	0.9±.3	3.2
Byzantine	Europe	10.5	2.0	395 A.D.	0.0	3.5
Hsiung Nu Hun	C. Asia	9±2	7±1	190 B.C.	0.2	1.0±.2
Maghada-Maurya	India	5.5	2.9	300 B.C.	1.4	0.9
Kushan	Indo-Iran	5.5	2.0	75 A.D.	0.5	2.0
Liu-Sung	China	5.1	2.5	330 A.D.	0.15	2.1±.4
T'u Chueh Turk	C. Asia	4±1	5±1	550 A.D.	0.1	0.9
Hun	Europe	4±1	3.3±.8	380 A.D.	0.6±.2	0.8±.2
Saka	Indo-Iran	3.6	2.2	50 B.C.	1.1±.2	1.2±.2
White Hun	Indo-Iran	3.1	3.4	460 A.D.	0.1	1.0
Western Turk	C. Asia	3±1	3±1	582 A.D.	0.0	0.7
Toba	China	2.8	1.9	440 A.D.	0.4	1.3
Ptolemaic	Africa	2.5	0.9	323 A.D.	0.0	2.9
Bactria	Indo-Iran	2.4	2.0	200 A.D.	0.7	0.6
Yuen-Yuen	C. Asia	2.2	2.3	400 A.D.	0.1	0.3
Gupta	India	2.0	1.2	370 A.D.	0.3±.1	0.9
Andhra	India	2.0	0.4	170±20 B.C.	0.3±.2	3.7
Avar	Europe	1.5±.5	0.7±.2	580±20 A.D.	?	2.0±.2
Visigoth	Europe	1.5	0.4	470 A.D.	0.5±.2	2.4

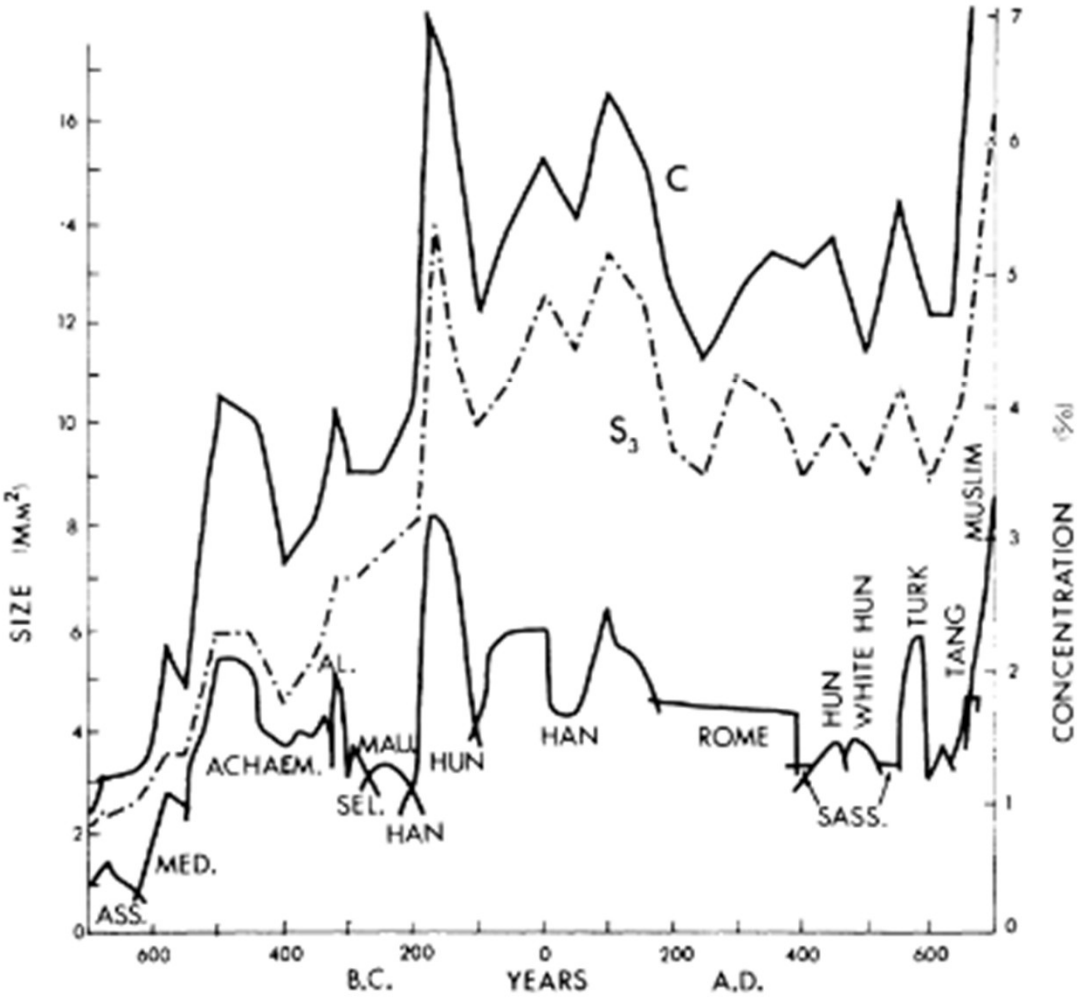
Note: Empires are listed in decreasing order of size-time integral. Those with $I < 1.5$ Mm^2c are omitted. Possible error range is 10% on I, M, R and D, and 10 years on A, unless a different range is indicated. Data from previous Tables and from measurements using Figure 1.

Size-time integrals (in Mm^2c) for the components of composite empires: Ch'in 1.1, Western Han 9.5, Eastern Han 9.7, Wei-Chin 1.7; Parthia 9, Sassanid 13; pre-partition Rome 20, West Roman 1.3; Media 2.8, Achaemenid 9.8, Alexander 1.1, Seleucid 3.3.

least 3 centuries (three Egyptian empires, Hsia-Shang, and Elam). Thus no increase in duration of empires is seen although they have become much larger during the period considered here.

Rise times from emergence to stable size range from 10 years to nearly 2 centuries. Preliminary studies (Taagepera, 1972) have suggested that the duration-rise ratio (D/R) tends to be close to 3 for most empires, once one excludes splinter empires such as the Ptolemaic and Byzantine empires. Although the median of the D/R ratios resulting from Table 5 is close to 3, the individual values range from 0.5 to 15. In view of the wide uncertainty, in particular regarding the rise times, no conclusions can be drawn.

Figure 2. Worldwide Territorial Concentration Trends, 700 B.C. to 700 A.D.*



*Size of largest empire, size of 3 largest empires combined (S_3), and concentration index (C). Data from Table 6.

WORLD-WIDE CONCENTRATION

Instead of individual empires let us now consider the world. The bottom curve in Figure 2 shows the world's largest empire size at any time from 700 B.C. to 700 A.D. The Achaemenid, Han, and Roman empires dominate the world scene, along with various Hun and Turkish empires of relatively brief duration. The size of the largest empire does not tend to increase systematically during most of the period considered, in contrast to the tremendous increase that took place from 700 to 500 B.C. The picture is somewhat different when

Table 6 World geographical concentration index (C) for political entities, and combined size (S_3) of 3 largest empires

Years (B.C.)	C(%)	$S_3(Mm^2)$	Years (A.D.)	C(%)	$S_3(Mm^2)$
700	.9	2	0	5.9	12.5
665	1.2	2.5	50	5.4	11.5
600	1.4	3	100	6.4	13.5
585	2.2	3.5	150	5.9	12.5
550	1.9	3.5	200	4.8	9.5
500	4.1	6	250	4.4	9
450	3.9	6	300	4.9	11
400	2.8	4.5	350	5.2	10.5
350	3.1	5.5	400	5.1	9
323	4.0	7	450	5.3	10
300	3.5	7	500	4.4	9
250	3.5	7.5	550	5.6	11
200	4.0	8	600	4.7	9
175	7	14	650	6.5	11
150	6.5	12	700	8	17
100	4.7	10			
50	5.4	11			

Note: Data from Figure 1 and Tables 1 to 4. C (in equivalent % of world dry land area) calculated using Equation on page 120. A list of 3 largest empires and their sizes is given in Taagepera (1978a).

one considers the combined size (S_3) of the world's three largest empires. For 600 A.D. to 600 B.C., S_3 is tabulated in Table 6, and is plotted versus time as a dashed curve in Figure 2. (A preliminary list of the three largest empires and their separate sizes was given in Taagepera, 1978a; the present values include some minor corrections.) The value of S_3 continues to increase up to 200 B.C. before leveling off, reflecting the fact that, instead of harboring one large empire at a time, the world now tends to include several large empires at the same time. While the organizational ability to hold large territories under the same rule did not seem to increase, from 500 to 200 B.C., the existing skills seemed to spread from Iran to the West (Rome) and to the East (Han), or were developed there independently and almost simultaneously.

The geographical concentration of the world regarding political entities is expressed by the index C which is also listed in Table 6 and is shown as the top curve in Figure 2 where its percentage scale is shown at the right edge of the plot. In confirms the observations made regarding S_3. Because C avoids the arbitrary cutoff at 3 empires, C is to be preferred to S_3. Its value which gradually edged up from 0.1 to 1 equivalent percentage of the world dry earth area, from 3000 to 700 B.C., rapidly increases to 6 equivalent percent during the next 5 centuries, and then levels off for 8 centuries, until the rise of the Muslim empire introduced a new major increase.

CONCLUSIONS

Area data have been compiled and tabulated for about 35 of the largest and most durable empires and states which reached their peak sizes between 600 B.C. and 600 A.D. The resulting size-versus-time curves have been plotted (Figure 1) to obtain an overview of the major territorial agglomerations, of their relative size, and of their overlap (or absence of overlap) in time. This plot might be of interest for students of general history. On a more analytical level, various size, growth, and duration characteristics have been defined, measured, and tabulated for 22 major empires, some of which were found to be composite empires according to preset operational criteria. These characteristics suggest a trend toward larger empires without a noticeable increase in duration. On a world-wide level, rapid increase in territorial concentration is observed during the period considered. Apart from these immediate conclusions, the essay also represents a stage in accumulation of data for further analysis of long-range trends that can be undertaken when later history has been analyzed in a similar manner.

Soon after 600 A.D. the Muslim empire surpassed any previous empire in size, and China was reunited under the T'ang dynasty. The territorial concentration of the world took another step up (though not necessarily forward). The 600 years following this expansion will be discussed in a subsequent paper.

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